

Sex Ratio in some Indian Bats

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INTRODUCTION

The determination of accurate sex ratio in bats is rendered difficult because most of the species live in sexually segregated colonies throughout the year except during the season of copulation. Hence, records of the sex ratio in these animals can be valid if sufficient number of specimens are collected at random throughout the year from several colonies at frequent intervals. The data so far available from the literature on the subject indicates that there is an uneven sex ratio with the females outnumbering the males in most species of bats (Wimsatt 1945 ; Gopalakrishna 1947, 1955 ; Ramakrishna 1951 ; Pearson *et al.* 1952 ; Abdulali 1949 ; Ramaswamy 1962 ; Brosset 1962 a, b, c ; 1963). *Taphozous melanopogon* and *Hipposideros lankadiva* (Abdulali 1949) appear to be the only two exceptional species in which the males exceed the females.

This paper presents data pertaining to the sex ratio of the following species of bats : *Rousettus leschenaulti* (Desmaret), *Taphozous longimanus* (Hardwicke), *Megaderma lyra lyra* (Geoffroy), *Hipposideros fulvus fulvus* (Gray), *Hipposideros speoris* (Schneider), *Hipposideros ater ater* (Templeton), *Pipistrellus ceylonicus chrysothrix* (Wroughton), *Pipistrellus mimus mimus* (Wroughton) and *Pipistrellus dormeri* (Dobson). The specimens belonging to all these species, except *Taphozous longimanus*, were collected from various places in Marathwada in Maharashtra. The specimens of *Taphozous longimanus* were collected in and around Nagpur in Vidarbha, Maharashtra. In all the cases collections have been made for at least two consecutive years, and in some cases for three or four years. In most species all the calendar months of the year are represented by one or more collections. In those species having a sharply defined breeding season many collections were made during the breeding season when the males and the females live together.

Table 1 gives the monthwise collections of the specimens of all the species studied here. Infants of the two sexes are included under separate columns with respect to each species. This will not only give a clear picture of the sex ratio at different ages of life of the animals, but will indicate the months of the year when the young are carried by lactating mothers. Details of the breeding habits and associated phenomena are published elsewhere.

TABLE I
MONTHWISE DISTRIBUTION OF THE SPECIMENS COLLECTED OF THE VARIOUS SPECIES

Month	<i>Rousettus leschenaulti</i>				<i>Taphozous longimanus</i>				<i>Megaderma lyra lyra</i>				<i>Hipposideros fulvus fulvus</i>				<i>H. speoris</i>				<i>H. ater ater</i>				<i>Pipistrellus ceylonicus chrysothrix</i>				<i>P. minus minus</i>				<i>P. dormeri</i>						
	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d	a	b	c	d			
January	—	73	—	95	—	3	1	6	—	37	—	85	—	16	—	42	—	—	—	—	—	11	—	31	—	24	—	50	—	2	39	—	73	—	1	16	—	40	
February	—	62	—	70	—	5	2	7	—	24	—	32	—	5	11	—	—	7	—	24	—	23	—	56	—	10	—	37	—	22	—	33	—	—	11	—	37		
March	7	61	7	70	1	3	1	12	—	17	—	49	—	6	—	48	—	8	—	20	—	24	—	56	—	23	—	51	—	—	35	—	64	—	—	7	3	38	
April	35	74	34	128	—	—	—	—	—	7	—	18	4	4	3	17	—	5	—	11	—	1	—	8	—	20	—	34	—	18	—	39	—	—	5	4	10		
May	3	43	6	38	—	—	—	—	—	—	—	—	15	36	21	103	—	2	—	10	—	9	2	28	—	36	—	81	—	9	—	23	—	—	1	5	—	4	
June	—	38	—	55	1	1	2	7	—	2	—	7	—	23	—	44	—	—	—	—	—	13	6	7	36	—	42	—	68	—	13	—	22	—	—	1	14	—	12
July	2	17	2	38	—	2	1	5	—	2	—	2	—	10	—	4	—	—	—	—	—	5	—	8	—	56	—	124	—	12	14	8	40	—	2	6	1	16	
August	1	16	—	11	1	2	2	18	—	7	—	16	—	12	—	37	—	2	—	4	—	6	—	8	—	4	25	3	154	—	6	—	17	—	—	—	—	2	
September	—	29	—	34	2	12	5	20	—	—	—	6	—	10	—	13	—	—	—	—	—	2	—	4	—	62	23	65	142	—	3	4	2	17	—	1	8	1	25
October	—	9	—	19	2	4	2	23	—	17	—	25	—	32	—	39	—	—	—	—	—	9	—	9	—	2	40	—	65	—	1	5	1	4	—	—	—	—	—
November	—	68	—	67	2	3	2	12	—	65	—	92	—	19	—	20	—	3	—	17	—	8	—	16	—	31	—	47	—	2	24	7	48	—	6	—	—	26	
December	—	70	—	85	1	5	1	6	—	74	—	105	—	12	—	18	—	—	—	—	—	4	—	20	—	22	—	49	—	3	14	2	22	—	9	—	—	39	
Total	48	560	49	710	10	40	19	116	—	252	—	437	19	185	24	396	—	27	—	86	13	108	9	280	68	352	68	902	23	203	20	402	6	87	9	249			

Note :—Column (a)—Young males attached to the breasts of their mothers.
 Column (b)—Adult males.
 Column (c)—Young females attached to the breasts of their mothers.
 Column (d)—Adult females.

OBSERVATIONS AND CONCLUSIONS

Since random collections have been made from different colonies, in all the seasons for two or more years, and since the numbers of specimens collected are reasonably large in most of the species, the conclusions drawn from the collection should be valid. A study of Table 1 indicates that in all the species studied, there is a very wide disparity in the numbers of the males and females, and in every case the females outnumber the males. If the number of males in each species is calculated to a common denominator of one thousand females, then the number of males per one thousand females in each species is as in Table 2.

TABLE 2
NUMBER OF MALES PER ONE THOUSAND FEMALES IN THE ADULT STAGE

Species	No. of males per 1000 females
<i>Rousettus leschenaulti</i>	788
<i>Taphozous longimanus</i>	343
<i>Megaderma lyra lyra</i>	577
<i>Hipposideros fulvus fulvus</i>	467
<i>H. speoris</i>	314
<i>H. ater ater</i>	386
<i>Pipistrellus ceylonicus chrysothrix</i>	390
<i>P. mimus mimus</i>	505
<i>P. dormeri</i>	349

Note :—The numbers are corrected to the nearest whole number.

Although in most cases the number of young recovered may not warrant a definite conclusion regarding the sex ratio during infancy, it is noteworthy that in the case of *Rousettus leschenaulti* and *Pipistrellus ceylonicus chrysothrix*, where a large number of young of both the sexes were collected, there is almost a balanced sex ratio during juvenile life. Even in the other species, except *Taphozous longimanus*, the sex ratio of the juveniles is reasonably even, and at any rate, the disparity in the adult sex ratio is not reflected at the younger stage of life. This leads to the conclusion that during the growth period there is a preferential mortality of the males resulting in an abnormal adult sex ratio in these bats.

An interesting feature is that, except in the case of the three species of *Pipistrellus*, all other species studied had a single young in each litter, and in most cases only once a year. *Rousettus leschenaulti* produces two litters in the year (Gopalakrishna & Chaudhari, in press), and *Taphozous longimanus* breeds throughout the year in quick succession (Gopalakrishna 1954, 1955).

It is interesting to compare the present findings with the data of earlier workers on the subject. Wimsatt (1945) working on some

American species of bats (*Myotis lucifugus lucifugus*, *Pipistrellus subflavus*, *Eptesicus fuscus* and *Lasionycteris noctivagans*) indicated that in the summer colonies the females were preponderant and in the hibernating winter colonies there were more males. Since there were differences in the proportions of the two sexes in different colonies, no definite conclusion could be arrived at regarding the sex ratio in these species. An abnormal sex ratio with females far outnumbering the males was shown by one of us (1947) in *Scotophilus wroughtoni*, and by Ramakrishna (1951) in the Indian vampire bats. Pearson *et al.* (1952) have shown that whereas there is a balanced sex ratio among the juveniles of *Corynorhinus rafinesquei*, the counts of adults gave conflicting results. Abdulali (1949) recorded the sex ratio in 28 species of Indian bats, and showed that in all the species except two (*Taphozous melanopogon* and *Hipposideros lankadiva*) the females outnumbered the males. In the two exceptional species there were more males than females. About European species of bats Brosset (1963) stated, 'Recent researches have shown that the social life of the European species covers a short part of the sexual cycle.' After copulation the males and females live separately. Consequently it is not possible to determine the accurate sex ratio in these animals. He further stated that in *Miniopterus schreibersii* in France the sex ratio is equal at birth, but among the adults the females outnumber the males. Brosset (1962 a, b, c and 1963) has noted an unbalanced sex ratio with females more numerous than males in many Indian species of bats.

From the foregoing it is evident that in almost all the species of bats the females outnumber the males. Perhaps even in the exceptional cases, if collection of specimens are made all round the year, the females may turn out to be more than the males. The fact that in most cases there is an annual breeding cycle with a single young in the litter indicates that bats have a low fecundity. Since, in most cases, where valid data are available, there is a balanced sex ratio among the juveniles, the uneven sex ratio in the adult stage can only be due to the preferential mortality of the males during the growth period. This leads one to the conclusion that the higher mortality of the males among the bats may be an adaptation for effecting an economy to bring about an increase in the potential reproductive population by reducing the number of males in the adult population.

SUMMARY

1. The sex ratio in the following species of bats have been worked out on the basis of frequent collection of specimens at random from different colonies for at least two consecutive calendar years—*Rousettus leschenaulti*, *Taphozous longimanus*, *Megaderma lyra lyra*, *Hipposideros*

fulvus fulvus, *H. speoris*, *H. ater ater*, *Pipistrellus ceylonicus chrysothrix*, *P. mimus mimus* and *P. dormeri*.

2. In all the cases there is an unbalanced sex ratio in the adult with females far outnumbering the males, whereas the sex ratio is even during the juvenile life.
3. The present findings are compared with those of earlier workers.
4. It is concluded that the uneven sex ratio in the adults is due to the preferential mortality of the males during the growth period.

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